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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/711,700	09/30/2004	Kevin S. Petrarca	FIS920040258US1	5699
32074 7590 10/30/2007 INTERNATIONAL BUSINESS MACHINES CORPORATION DEPT. 18G BLDG. 300-482 2070 ROUTE 52 HOPEWELL JUNCTION, NY 12533			EXAMINER NGUYEN, TRAM HOANG	
			ART UNIT 2818	PAPER NUMBER
			MAIL DATE 10/30/2007	DELIVERY MODE PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/711,700

Applicant(s)

PETRARCA ET AL.

Examiner

Tram H. Nguyen

Art Unit

2818

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 14 June 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,4,5,13 and 15 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,4,5,13 and 15 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____.
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- ☐ Notice of Informal Patent Application
- ☐ Other: _____.

DETAILED ACTION

In response to the communications dated 06/14/2007, claims 1,4-5,13 and 15 are pending in this application.

Response to Arguments

Applicant's arguments, see Remark, filed 06/14/2007, with respect to claims 1 and 13 have been fully considered and are persuasive. The rejection of claim 1 and 13 has been withdrawn.

Claim Objections

Claims 1 and 13 are objected to because of the following informalities:

Line 3 of claim 1, "impurities"—should be changed to "impurity".

Line 13 of claim 1, the phrase "said first impurity content of said impure copper seed layer"-- should be changed to "said first content of impurity of said impure copper seed layer".

Line 9 of claim 13, "impurities"—should be changed to "impurity"

Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 13 recites the limitation "the impure copper fill" in line 14. There is insufficient antecedent basis for this limitation in the claim. Moreover, the wording in

paragraph 5 of claim 13 is totally contradicting each other because Applicant claims "said copper source of said impure copper seed layer is equivalent to said copper source of the impure copper" (as noted in lines 12-13 of claim 13). But then in following sentence explains there is different between the impure copper seed layer and the impure copper fill (i.e., "however some impurities in the impure copper fill are absent from the impure copper seed layer..."). For the remainder of the Action, the Examiner will interpret the limitation in paragraph 5 of the claim 13 as the newly amended claim 1, wherein the "impure copper seed is substantially the same as material composition of said impure copper fill except some impurities in the impure copper fill are absent from the impure copper seed layer as a consequence of deposition of the impure copper seed layer."

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was

not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1,4-5,13,15 rejected under 35 U.S.C. 103(a) as being unpatentable over Andricacos et al. (US 6,709,562; hereinafter Andricacos) and further in view of Noriyoshi et al. (JP 11-297696; hereinafter Noriyoshi)

Regarding **claim 1**, Andricacos discloses a copper interconnect (fig. 6) comprising: a copper seed layer (reference numeral 5) is deposited on a barrier layer (reference numeral 4), said barrier layer (4) prevents substantial diffusion of copper through to an underlying insulating layer (reference numeral 1).

Andricacos does not explicitly teach the impure copper seed layer derived from a first impure copper source. However, Noriyoshi teaches a similar copper interconnect structure (see fig. 1B- 1C and 2B) wherein the copper seed layer (7) contains Sn 0.5 % of the weight as impurity (see Noriyoshi's Specification in English translation: par.[0021] and fig. 1B). Therefore, it would have been obvious to one having ordinary skills in the art at the time the invention was made to include the impure copper seed layer derived from a first impure copper source as taught by Noriyoshi in the copper interconnect as disclosed by Andricacos so that it forms a high electromigration-resistance Cu wiring having a high adhesion to the base surface (see Noriyoshi's Abstract).

Fig. 6 of Andricacos teaches an impure copper (reference numeral 6) derived from an impure copper source (6) with a content of impurities (see col. 2, lines 60-67)

that fills an opening in said underlying insulating layer (1) that is deposited on said impure copper seed layer (5).

The combination of Andricacos and Noriyoshi teaches the material composition of the impure copper seed layer (Note: the copper seed layer 7 in Noriyoshi "contains Sn 0.5% of the wt as the impurity" as recited from par.[0021]) is substantially the same as material composition of said impure copper fill (Note: in col. 2, lines 60-67 of Andricacos exhibits that the impure copper fill contains a small amounts of a materials in the Cu selected from the group consisting of C (less than 2 wt %), O (less than 1 wt %), N (less than 1 wt %), S (less than 1 wt %) and Cl (less than 1 wt %)) except some impurities in the impure copper fill are absent from the impure copper seed layer.

The limitation "as a consequence of deposition of the impure copper seed layer" refers to a product by process claim is directed to the product per se, no matter how actually made, In re Hirao, 190 USPQ 15 at 17 (footnote 3). See also In re Brown, 173 USPQ 685; In re Luck 177 USPQ 523; In re Fessman 180 USPQ 324; In re Avery 186 USPQ 161; In re Wertheim 191 USPQ 90; and In re Marosi et al 218 USPQ 289, all of which make it clear that it is the patentability of the final product per se which must be determined in a "product by process claim, and not the patentability of the process, and that an old product produced by a new method is not patentable as a product, whether claimed in "product by process claims or not. Note that applicant has the burden of proof in such cases, as the above caselaw makes clear.

Noriyoshi teaches said first impurity content of said impure copper seed layer comprises not more than 1.2% by weight and not less than or equal to 0.001% by

weight (Note: the copper seed layer 7 in Noriyoshi "contains Sn 0.5% of the wt as the impurity" as recited from par.[0021]).

Regarding **claim 4**, Andricacos And Noriyoshi disclose all the limitations of the claimed invention for the same reasons are set-forth above. Besides, the combination of Andricacos and Noriyoshi teaches the material composition of the impure copper seed layer (Note: the copper seed layer 7 in Noriyoshi contains Sn 0.5% of the wt as the impurity as recited from par.[0021]) is substantially the same as material composition of said impure copper fill (Note: in col. 2, lines 60-67 of Andricacos exhibits that the impure copper fill contains a small amounts of a materials in the Cu selected from the group consisting of C (less than 2 wt %), O (less than 1 wt %), N(less than1wt %), S (less than1wt %) and Cl (less than1 wt %))

Regarding **claim 5**, Andricacos And Noriyoshi disclose all the limitations of the claimed invention for the same reasons are set-forth above. Besides Noriyoshi teaches the material composition of the impure copper seed layer (7) contains Sn 0.5% of the wt as the impurity (par.[0021] of Noriyoshi). Andricacos exhibits that the impure copper fill contains a small amounts of a materials in the Cu selected from the group consisting of C (less than 2 wt %), O (less than 1 wt %), N(less than1wt %), S (less than1wt %) and Cl (less than1 wt %) (in col. 2, lines 60-67 of Andricacos)

Regarding **claim 13**, Andricacos discloses a copper interconnect (fig. 6) comprising: an insulating layer (1) that has an opening; a barrier layer (4) that prevents substantial diffusion of copper through to said underlying insulating layer that is

deposited on said underlying insulating layer (1) and lines said opening (see fig. 6); an copper seed (5) deposited on said barrier layer (4) and fills said opening (see fig. 6).

Andricacos does not explicitly teach the impure copper seed layer derived from a first impure copper source. However, Noriyoshi teaches a similar copper interconnect structure (see fig. 1B- 1C and 2B) wherein the copper seed layer (7) contains Sn 0.5 % of the weight as impurity (see Noriyoshi's Specification in English translation: par.[0021] and fig. 1B). Therefore, it would have been obvious to one having ordinary skills in the art at the time the invention was made to include the impure copper seed layer derived from a first impure copper source as taught by Noriyoshi in the copper interconnect as disclosed by Andricacos so that it forms a high electromigration-resistance Cu wiring having a high adhesion to the base surface (see Noriyoshi's Abstract).

Fig. 6 of Andricacos shows an impure copper (reference numeral 6) fills (see col. 2, lines 60-67) an opening in said underlying insulating layer (1).

The combination of Andricacos and Noriyoshi teaches the material composition of the impure copper seed layer (Note: the copper seed layer 7 in Noriyoshi "contains Sn 0.5% of the wt as the impurity" as recited from par.[0021]) is substantially the same as material composition of said impure copper fill (Note: in col. 2, lines 60-67 of Andricacos exhibits that the impure copper fill contains a small amounts of a materials in the Cu selected from the group consisting of C (less than 2 wt %), O (less than 1 wt %), N (less than 1 wt %), S (less than 1 wt %) and Cl (less than 1 wt %)) except some impurities in the impure copper fill are absent from the impure copper seed layer.

The limitation “as a consequence of deposition of the impure copper seed layer” refers to a product by process claim is directed to the product per se, no matter how actually made, In re Hirao, 190 USPQ 15 at 17 (footnote 3). See also In re Brown, 173 USPQ 685; In re Luck 177 USPQ 523; In re Fessman 180 USPQ 324; In re Avery 186 USPQ 161; In re Wertheim 191 USPQ 90; and In re Marosi et al 218 USPQ 289, all of which make it clear that it is the patentability of the final product per se which must be determined in a “product by process claim, and not the patentability of the process, and that an old product produced by a new method is not patentable as a product, whether claimed in “product by process claims or not. Note that applicant has the burden of proof in such cases, as the above caselaw makes clear.

Noriyoshi teaches said first impurity content of said impure copper seed layer comprises not more than 1.2% by weight and not less than or equal to 0.001% by weight (Note: the copper seed layer 7 in Noriyoshi “contains Sn 0.5% of the wt as the impurity” as recited from par.[0021]).

Regarding **claim 15**, Andricacos discloses all the limitations of the claimed invention for the same reasons are set-forth above. Besides Noriyoshi teaches the material composition of the impure copper seed layer (7) contains Sn 0.5% of the wt as the impurity (par.[0021] of Noriyoshi).

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tram Hoang Nguyen whose telephone number is (571)272-5526. The examiner can normally be reached on Monday-Friday, 8:30 AM – 5:00 PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Steven Loke can be reached on (571)272-1657. The fax numbers for all communication(s) is (703)872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (571)272-1625.

THN
Art Unit 2818
10/14/2007

STEVEN LOKE
SUPERVISORY PATENT EXAMINER

